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SELECTED BIOLOGICAL SURVEYS IN THE JAMES RIVER BASIN. GILLIE CREEK IN THE RICHMOND AREA, APPOMATTOX RIVER IN THE PETERSBURG AREA, BAILEY CREEK FROM FORT LEE TO HOPEWELL

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Millie Creek to the Richmond Area

Appomattox River to the Petersburg Area

Bailey Creek from Fort Lee to Hopewell

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I. INTRODUCTION

Biological surveys of Gillie Creek in the Richmond area, the Appomattox River in the Petersburg area, and Bailey Creek between Fort Lee and Hopewell (all tributaries of the James River in Virginia) were conducted in August 1967. The surveys were centered on these areas, as each of them was known to have serious pollution problems, and additional data were needed.

Gillie Creek was surveyed from Oakley Lane north of Virginia Heights to its mouth at Dock Street in Richmond. The Appomattox River was surveyed upstream from Petersburg at the Virginia Route 36 Bridge and downstream from Petersburg at the Virginia Route 10 Bridge. Bailey Creek was surveyed from its headwaters on the Fort Lee Military Reservation to its mouth near the Virginia Route 10 Bridge.

For purposes of the study, the community of bottom (benthic) organisms was selected as indicator of the biological condition of the stream. Bottom organisms serve as the preferred food source for higher aquatic forms and exhibit similar reactions to adverse stream conditions. The combination of limited locomotion and life cycles of one year or more, for most benthic species, provide a long-term picture of the water quality of a stream. Fish and algal populations were given some consideration, but only to the extent that obvious conclusions could be drawn based upon incidental observations.

In unpolluted streams a wide variety of sensitive clean-water associated bottom organisms is normally found. Typical groups are stoneflies, mayflies, and caddisflies. These sensitive organisms

usually are not individually abundant because of natural predation and competition for food and space; however, the total count of organisms at a given station may be high because of the number of different varieties present.

Sensitive genera (kinds) tend to be eliminated by adverse environmental conditions (chemical, physical, and biological) resulting from wastes reaching the stream. In waters enriched with organic wastes, comparatively fewer kinds are normally found, but great numbers of these genera may be present. Organic pollution-tolerant forms such as sludgeworms, rattailed maggots, certain species of bloodworms such as red midges, certain leeches, and some species of air-breathing snails may multiply and become abundant because of a favorable habitat and food supply. These organic pollution-tolerant bottom organisms may also exist in the natural environment but are generally found in small numbers. The abundance of these forms in streams heavily polluted with organics is due to their physiological and morphological abilities to survive environmental conditions more adverse than conditions that may be tolerated by other organisms. When inert silts or organic sludges blanket the stream bottom, the natural home of bottom organisms is destroyed, causing a reduction in the number of kinds of organisms present.

In addition to sensitive and pollution-tolerant forms, some bottom organisms may be termed intermediates, in that they are capable of living in fairly heavily polluted areas as well as in clean-water situations. These organisms occurring in limited numbers, therefore, cannot serve as effective indicators of water quality.

Streams grossly polluted with toxic wastes such as mine drainage will support little, if any, biological life and will reduce the population of both sensitive and pollution-tolerant organisms.

Classification of organisms in this report is considered in three categories (clean-water associated, intermediate, and pollution-tolerant) which provide sufficient biological information to supplement physical and chemical water quality data for a basin-wide analysis. Detailed identification and counts of specific organisms have been tabulated and are available upon request.

II. SUMMARY AND CONCLUSIONS

1. Biological surveys of Gillie Creek in the Richmond area, the Appomattox River in the Petersburg area, and Bailey Creek between Fort Lee and Hopewell were conducted in August 1967. All three of these streams are tributaries to the James River.

2. Bottom organisms were selected as the primary indicator of biological water quality.

3. Gillie Creek was found to be mildly polluted from its headwaters near Virginia Heights, which is located east of Richmond, to Laburnum Road (Virginia Route 672). Fair biological conditions were found at Jennie Scher Road, indicating some recovery from the upstream station. Downstream at the Fulton Street Bridge in Richmond, however, heavy organic pollution was found, and this continued to the mouth at Dock Street in Richmond. Gillie Creek contributes poor quality water to the James River.

4. The Appomattox River was sampled upstream from Petersburg at the Virginia Route 36 Bridge, and high water quality was found.

Downstream from Petersburg at the Virginia Route 10 Bridge, degraded biological conditions were found. The Appomattox River contributes poor quality water to the James River.

5. Bailey Creek was found to exhibit fair biological conditions in its headwaters near the Fort Lee Hospital. Downstream from Fort Lee it becomes polluted, and, as it enters the Hopewell industrial complex, it is grossly polluted by industrial wastes. Bailey Creek contributes a high pollutional load to the James River.

6. The James River was inspected off Bailey Creek and the Hopewell industrial complex. Gravelly Run, which drains part of the industrial complex, was found to be contributing thermal pollution to the James River. The River on the Hopewell side appears to be grossly polluted throughout this reach.

III. DATA EVALUATION AND INTERPRETATION

As part of selected biological surveys, Gillie Creek, the Appomattox River, and Bailey Creek were found to be contributing poor quality water to the James River.

In addition, Gravelly Run, which drains part of the Hopewell industrial complex, was found to be contributing thermal pollution to the James River. Because of the magnitude of the industrial development and the tidal action, it was impossible to pinpoint the sources; but the Hopewell area is without doubt one of the more seriously polluted areas in the entire James River Basin. A more detailed study is definitely needed in this area.

Sampling stations were located after consideration of the following conditions:

1. Effects of tributaries
2. Areas having a known water quality problem
3. Physical capability for sampling

Bottom organisms are animals that live directly in association with the bottom of a waterway. They may crawl on, or burrow in, or attach themselves to the bottom. Macro-organisms are usually defined as those organisms that will be retained by a No. 30 sieve. In essence, the organisms retained by the sieve are those that are visible to the unaided eye.

Each station was sampled once, and the kinds of macro bottom organisms were observed for the purpose of evaluating water quality.

Quantitative bottom samples were also taken, using a Surber Square Foot Sampler, a Petersen Dredge (0.6 sq. ft.) or an Ekman Dredge (0.5 sq. ft.), and the number of organisms per square foot was counted or calculated.

Quantitative samples were not taken at stations in non-critical areas or where organisms were very sparse.

Discussions of stations proceed downstream unless otherwise noted.

Gillie Creek in the Richmond Area

Station #1 - Gillie Creek at the Oakley Lane Bridge north of the drive-in theatre at Virginia Heights

The water was clear, and filamentous algae were abundant, suggesting excessive nitrogen and phosphorus. This station was located in the headwaters, and the stream was quite small at this location. Bottom organisms were not abundant, and only seven genera (kinds) were found. They consisted of pollution-tolerant bloodworms, sludgeworms, another bristleworm, the intermediate flatworms, and intermediate midge larvae (three genera). Only 43 organisms were found in the square foot sample, consisting of 32 sludgeworms, two bristleworms, six bloodworms, and three intermediate midge larvae. Mild organic pollution was indicated and is probably the result of septic tank failures and seepage from the surrounding surburban developments.

Station #2 - Gillie Creek at Laburnum Road (Virginia Route 672) Bridge east of Richmond

Although the stream banks were littered with trash along Laburnum Road, the water remained clear; however, bottom organisms were sparse, and a quantitative sample was not taken for this reason. Six genera of bottom organisms were found, consisting of one clean-water associated mayfly, two intermediate midge larvae, and three pollution-tolerant air-breathing snails. Mild organic pollution was still indicated.

Station #3 - Gillie Creek at the Ford at Jennie Scher Road in Richmond

The stream was clear in spite of the road construction in the area, and nine genera of bottom organisms were found which consisted of clean-water associated mayflies (two genera), caddisflies, intermediate midge larvae (two genera), and pollution-tolerant sludgeworms, bloodworms, and air-breathing snails (two genera). Out of a total of 217 bottom organisms in the square foot sample, there were 205 intermediate midge larvae, 11 sludgeworms, and one bloodworm. Only fair biological conditions were indicated at this location.

Station #4 - Gillie Creek at the Fulton Street Bridge in Richmond

The water was turbid, and an extremely strong raw sewage odor was present. The bottoms of the rocks were black, and all of the rocks were covered with a sewage mold. Large quantities of trash and garbage littered the banks, and domestic waste was observed in the stream. Outhouses were present in the area. A large sewer pipe was observed under the bridge but was not discharging at the time of the inspection. As preparations were underway for inspection of the stream, a pickup truck loaded with garbage approached the bridge. The truck's occupants were about to dump the garbage when they became aware of the inspection party's presence and hastily drove away.

The only bottom organisms sampled were sludgeworms and bloodworms. In spite of the large sludgeworm and bloodworm populations in the sludge banks, the quantitative sample taken in

the gravel in midstream produced only two large bloodworms. Gross organic pollution was indicated at this station.

Station #5 - Gillie Creek at the Dock Street Bridge at the mouth in Richmond

The water was turbid, and the quantitative sample had the odor of oil and decomposing organic matter. Gas storage tanks are in the vicinity. Outfalls with evidence of previous flow were observed but were not discharging at the time of inspection. The only bottom organisms found were sludgeworms, but only 46 were collected in the square foot sample. Toxic wastes may be keeping down the sludgeworm population. Gross pollution was indicated, and poor water quality was contributed to the James River.

The Appomattox River in the Petersburg Area

Station #1 - Appomattox River at the Virginia Route 36 Bridge upstream from Petersburg

This station was selected after an abortive attempt to sample the River at Matoaca, which is the first bridge crossing upstream from Petersburg. Due to a dangerously shifting sand bottom created by the construction work on the new bridge and poor access on the side opposite Matoaca, the next bridge crossing upstream was substituted.

The water was slightly turbid, but a moss was present on the rocks. High water quality was indicated by 19 genera of bottom organisms, including such clean-water associated forms as

stoneflies (two genera), mayflies (four genera), caddisflies (four genera), hellgrammites, and a gill-breathing snail. Only 14 bottom organisms were collected in the square foot sample, but this was due to the extremely large rocks in the stream bottom which prevented efficient quantitative sampling even with the square foot sampler. The quantitative sample consisted of 12 mayflies, one caddisfly larva, and one fingernail clam. The qualitative sample indicated good populations of stoneflies, mayflies, caddisflies, and gill-breathing snails. In addition, good biological conditions were suggested by the fishermen with pickerel, channel catfish, bluegill, and a large shiner in their creels.

Station #2 - Appomattox River near its mouth at the Virginia Route 10 Bridge

This station was located downstream from Petersburg and north of Hopewell. The water was turbid, but a few fish (primarily shad) were observed in the area. This station was sampled by boat using an Ekman Dredge due to the river depth. The only bottom organisms sampled were sludgeworms and midge larvae. The quantitative sample on a square foot basis consisted of 55 sludgeworms and seven intermediate midge larvae. Mild pollution appears to be indicated at this station. Poor quality water is contributed to the James River by the Appomattox River.

Bailey Creek between Fort Lee and Hopewell

Station #1 - Bailey Creek in its headwaters at the "A" road crossing southeast of the Fort Lee Hospital

The water was clear, and minnows were abundant at this station. Bottom organisms were not too abundant, and only five genera of bottom organisms were sampled. They consisted of clean-water associated mayflies, intermediate midge larvae (three genera), and a pollution-tolerant sludgeworm.

Only fair biological conditions were indicated. Bottom organism diversification could be limited by the habitat and possible spraying for mosquitoes. This station is upstream from any known discharge.

Station #2 - Bailey Creek at the Virginia County Road 630 Bridge downstream from Fort Lee

The water was turbid and had a whitish-gray color. A strong sewage odor was present. The underside of the gravel in the stream bed was black, and sewage mold was present on the rocks. In spite of an intensive search, bottom organisms could not be found. Degraded biological conditions are indicated at this location.

Station #3 - Bailey Creek at the Virginia Route 156 Bridge at the south edge of Hopewell

The water remained a very turbid whitish-gray color even in the sampling bucket. The only bottom organisms which could be found were sludgeworms, and they were not very abundant. Only 36

sludgeworms were collected in the square foot sample. Polluted conditions are suggested at this location.

Station #4 - Bailey Creek at Virginia Route 10 Bridge at the east edge of Hopewell

The water was a black color with a great amount of white floc floating on it. Strong chemical odors were noted. Since this station is within the range of tidal excursion, part of this pollution evidence may be carried up from the James River in addition to the pollution coming downstream. Bottom organisms could not be found at this location.

Extremely heavy industrial pollution was indicated at this station.

Station #5 - Mouth of Bailey Creek and the James River off Hopewell

The James River was investigated off Hopewell and the mouth of Bailey Creek. The water off the industrial complex was dark and flocculent, with a great deal of dead filamentous algae. The area along the bank was heavily silted and remained shallow a considerable distance out from the bank. Gravelly Run, which drains part of the industrial complex, was observed to be contributing a large volume of thermal pollution. The mouth of Bailey Creek was very similar to its upstream station. Bottom organisms could not be found in either section. Heavy industrial pollution was indicated.

TABLE I

BOTTOM ORGANISM DATA OF GILLIE CREEK

Station Number	Location	Bottom Organisms		Dominant Forms	Indicated Water Quality
		No. of Kinds	No. Per Sq. Ft.		
1	Gillie Creek at the Oakley Lane Bridge north of the drive-in theatre at Virginia Heights	7	43	Sludgeworms Bloodworms	Mild organic pollution
2	Gillie Creek at Laburnum Road (Va. Rt. 672) Bridge east of Richmond	6	-	Intermediate Midge Larvae Air-breathing Snails	Mild organic pollution
3	Gillie Creek at the ford at Jennie Scher Road in Richmond	9	217	Intermediate Midge Larvae	Fair
4	Gillie Creek at the Fulton Street Bridge in Richmond	2	2	Sludgeworms Bloodworms	Gross pollution
5	Gillie Creek at the Dock Street Bridge at the mouth in Richmond	1	46	Sludgeworms	Gross pollution

TABLE II

BOTTOM ORGANISM DATA OF APPOMATTOX RIVER

Station Number	Location	Bottom Organisms		Dominant Forms	Indicated Water Quality
		No. of Kinds	No. Per Sq. Ft.		
1	Appomattox River at the Virginia Route 36 Bridge upstream from Petersburg	19	14	Mayflies Caddisflies Stoneflies	Excellent
2	Appomattox River near its mouth at the Virginia Route 10 Bridge	2	62	Sludgeworms and Intermediate Midge Larvae	Mild pollution

TABLE III

BOTTOM ORGANISM DATA OF BAILEY CREEK

Station Number	Location	Bottom Organisms		Dominant Forms	Indicated Water Quality
		No. of Kinds	No. Per Sq. Ft.		
1	Bailey Creek in its headwaters at the "A" road crossing southeast of the Fort Lee Hospital	5	-	Mayflies Intermediate Midge Larvae Sludgeworms	Fair
2	Bailey Creek at the Va. County Rd. 630 Bridge downstream from Fort Lee	0	0		Polluted
3	Bailey Creek at the Va. Rt. 156 Bridge at the south edge of Hopewell	1	36	Sludgeworms	Polluted
4	Bailey Creek at Va. Rt. 10 Bridge at the east edge of Hopewell	0	0		Heavy pollution
5	Mouth of Bailey Creek and the James River off Hopewell	0	0		Heavy pollution

TABLE IV

TABULATION OF BOTTOM ORGANISMS BY STATION ON GILLIE CREEK

August 1967

Station Number and Location	Macro-Invertebrates Present	Present Only In Qualitative Sample	Number of Each Organism In Square Foot Sample	Per Cent of Quantitative Sample
1. Gillie Creek at Oakley Lane north of drive-in theatre at Virginia Heights, Va.	Turbellaria			
	Tricladia			
	Dugesia sp.	x		
	Oligochaeta			
	Dero sp.		2	4.65
	Tubifex sp.		32	74.42
	Diptera			
	Tendipedidae			
	Tendipes sp.		6	13.95
	Metriocnemus sp.	x		
	Pseudochironomus sp.		3	6.98
	Diamesinae	x		
	Total Number of Organisms per Square Foot		43	
2. Gillie Creek at Laburnum Road (Va. Rt. 672) near Richmond	Ephemeroptera			
	Baetis sp.	x		
	Diptera			
	Tendipedidae			
	Polypedilum sp.	x		
	Procladius sp.	x		
	Mollusca			
	Gastropoda			
	Pulmonata			
	Ferrissia sp.	x		
	Gyraulus sp.	x		
	Physa sp.	x		

TABLE IV (Continued)

Station Number and Location	Macro-Invertebrates Present	Present Only In Qualitative Sample	Number of Each Organism In Square Foot Sample	Per Cent of Quantitative Sample
3. Gillie Creek at the Ford Crossing at Jennie Scher Road at Richmond	Ephemeroptera			
	Baetis sp.	x		
	Stenonema sp.	x		
	Trichoptera			
	Hydropsyche sp.	x		
	Diptera			
	Tendipedidae			
	Tendipes sp.	x	1	0.46
	Hydrobaenus sp.	x	205	94.47
	Polypedilum sp.	x		
	Oligochaeta			
	Tubifex sp.		11	5.07
	Gastropoda			
	Physa sp.	x		
	Gyraulus sp.	x		
	Total Number of Organisms per Square Foot		217	
4. Gillie Creek at the Fulton Street Bridge in Richmond	Diptera			
	Tendipedidae			
	Tendipes sp.	x	2	100.00
	Oligochaeta			
	Tubifex sp.	x		
	Total Number of Organisms per Square Foot		2	
5. Gillie Creek at the Dock St. Bridge in Richmond	Oligochaeta			
	Tubifex sp.	x	46	100.00
	Total Number of Organisms per Square Foot		46	

TABLE V

TABULATION OF BOTTOM ORGANISMS BY STATION ON THE APPOMATTOX RIVER

August 1967

Station Number and Location	Macro-Invertebrates Present	Present Only In Qualitative Sample	Number of Each Organism In Square Foot Sample	Per Cent of Quantitative Sample
1. Appomattox River at the Virginia Rt. 36 Bridge	Turbellaria			
	Tricladia			
	Dugesia sp.	x		
	Crustacea			
	Malacostraca			
	Decapoda			
	Cambarus sp.	x		
	Ephemeroptera			
	Baetis sp.	x	1	7.14
	Heptagenia sp.	x		
	Isonychia sp.	x		
	Stenonema sp.		11	78.58
	Odonata			
	Anisoptera			
	Hagenius sp.	x		
	Tachopteryx sp.	x		
	Plecoptera			
	Perlinella sp.	x		
	Pteronarcya sp.	x		
	Megaloptera			
	Corydalus cornuta	x		
	Trichoptera			
	Chimarra sp.	x	1	7.14
	Hydropsyche sp.	x		
	Macronemum sp.	x		
	Wormaldia sp.	x		

TABLE V (Continued)

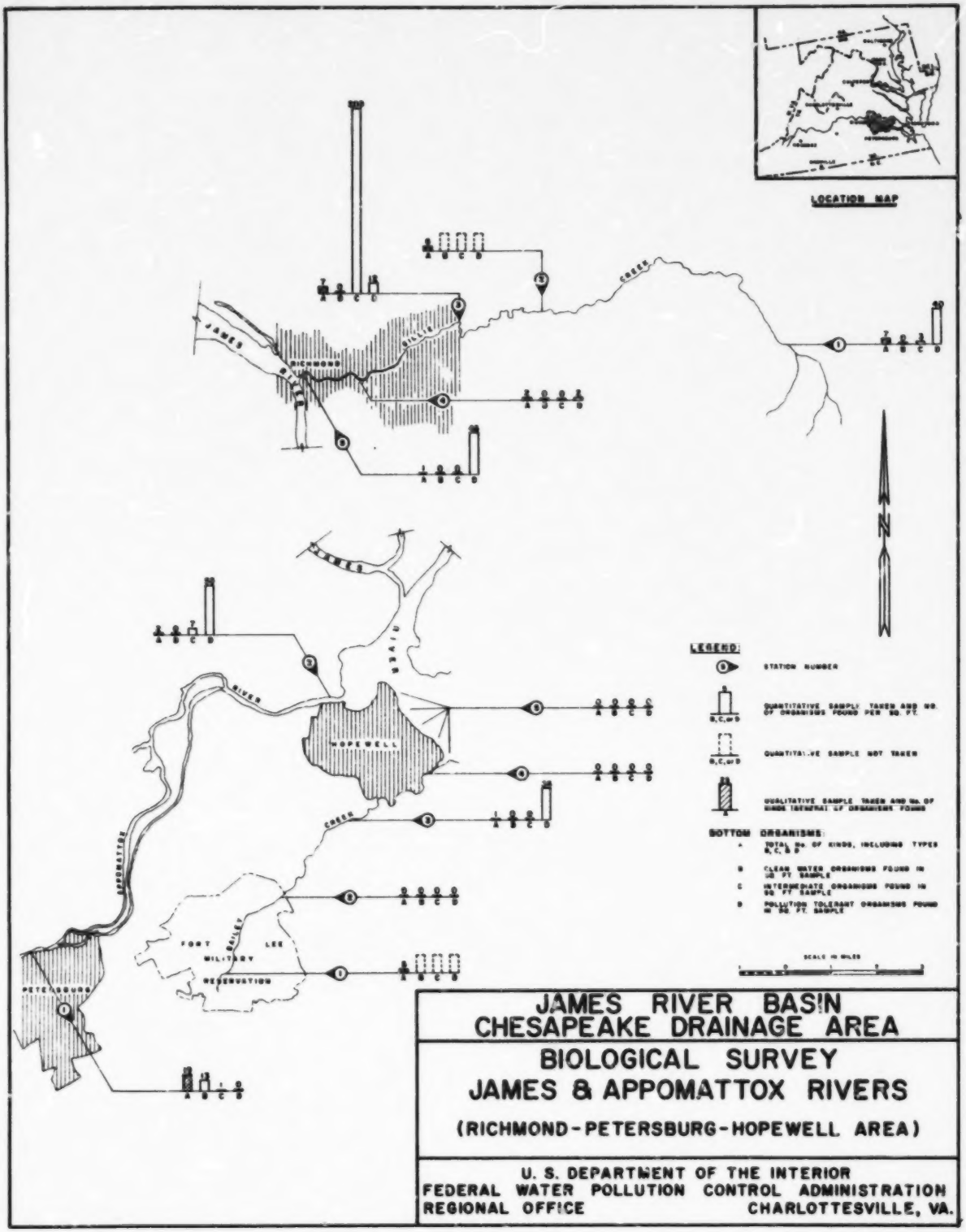
Station Number and Location	Macro-Invertebrates Present	Present Only In Qualitative Sample	Number of Each Organism In Square Foot Sample	Per Cent of Quantitative Sample
1. Appomattox River at the Virginia Rt. 36 Bridge (Continued)	Mollusca			
	Gastropoda			
	Prosobranchia			
	Lioplax sp.	x		
	Pleurocerca sp.	x		
	Pelecypoda			
	Sphaerium sp.	x	1	7.14
	Diptera			
	Simulium sp.	x		
	Total Number of Organisms per Square Foot		14	
2. Appomattox River approximately 100 yards upstream from Virginia Rt. 10 Bridge	Oligochaeta			
	Tubifex sp.	x	55	88.71
	Diptera			
	Tendipedidae			
	Procladius sp.	x	7	11.29
	Total Number of Organisms per Square Foot		62	

TABLE VI

TABULATION OF BOTTOM ORGANISMS BY STATION ON BAILEY CREEK

August 1967

Station Number and Location	Macro-Invertebrates Present	Present Only In Qualitative Sample	Number of Each Organism In Square Foot Sample	Per Cent of Quantitative Sample
1. Bailey Creek at the "A" St. crossing southeast of the Fort Lee Hospital	Ephemeroptera			
	Baetis sp.	x		
	Diptera			
	Tendipedidae			
	Cryptochironomus sp.	x		
	Polypedilum sp.	x		
	Tanytarsus sp.	x		
	Oligochaeta			
	Limnodrilus sp.	x		
2. Bailey Creek at the Virginia County Road 630 Bridge	Bottom organisms were not present			
3. Bailey Creek at the Virginia Rt. 156 Bridge	Oligochaeta			
	Tubifex sp.	x	36	100.00
4. Bailey Creek at the Virginia Rt. 10 Bridge	Bottom organisms were not present			
5. Bailey Creek at mouth	Bottom organisms were not present			



JAMES RIVER BASIN
CHESAPEAKE DRAINAGE AREA

BIOLOGICAL SURVEY
JAMES & APPOMATTOX RIVERS

(RICHMOND - PETERSBURG - HOPEWELL AREA)

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